UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2003/00765

July 9, 2003

Mr. Robert E. Willis
Chief, Environmental Resources Branch
Department of the Army
Portland District, Corps of Engineers
P.O. Box 2946
Portland, OR 97208-2946

Mr. John Malek
Team Leader, Sediment Management Program
Aquatic Resources Unit
U.S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101

Re: Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Mouth of the Columbia River Maintenance Dredging Program and Ocean Disposal Site Designation

Dear Mr. Willis and Mr. Malek:

NOAA's National Marine Fisheries Service (NOAA Fisheries) has reviewed the February, 2003 revised joint essential fish habitat (EFH) assessment of the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency (action agencies) for the Mouth of the Columbia River maintenance dredging program and designation of two ocean-dredged material disposal sites. This document transmits NOAA Fisheries' EFH conservation recommendations pursuant to section 305(b)(4)(A) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267).

The EFH assessment did not describe existing environmental conditions at one of the ocean disposal sites, the new *deep water site* (DWS), in sufficient detail to allow a thorough evaluation of how EPA's proposed designation would affect EFH, nor did it fully analyze effects of the designation on EFH. NOAA Fisheries requested additional information needed for the description of existing conditions, the analysis of effects on EFH, and monitoring of the DWS from EPA under the Fish and Wildlife Coordination Act on April 25, 2003, and met with EPA on Monday, May 12, 2003, and with EPA and the Corps on Monday, June 23, 2003, to discuss these issues. Based on these discussions, it is our understanding that EPA does not intend to

provide additional baseline information or perform additional effects analyses related to designation of the proposed DWS. Therefore, NOAA Fisheries is concluding this EFH consultation based on the information available to date.

NOAA Fisheries concludes that the proposed dredging and ocean disposal site designation will adversely affect EFH for groundfish, coastal pelagic species, and Pacific salmon. Disposal of dredged material at the proposed DWS will have adverse effects to EFH for groundfish within the designated disposal area. The DWS comprises a relatively large area, 10.5 square nautical miles; however, the relative importance of this area to managed fish species is unclear. Some of the groundfish species potentially affected by disposal at the DWS have been declared overfished by the Pacific Fishery Management Council. The overfished status of each of these species calls for a more detailed evaluation of potential impacts from the proposed activities to these species, and greater caution in assessing the significance of any adverse effects to EFH. To that end, we are providing a detailed effects analysis based on an expanded list of groundfish species. For coastal pelagic species and Pacific salmon, the mound of accumulated sediments resulting from disposal at the DWS could potentially affect EFH through alteration of physical processes in the water column, particularly the Columbia River plume.

A primary concern is whether the action agencies have gathered and provided adequate site-specific habitat information about the DWS. The sampling conducted in June and September of 2002 may not have provided sufficient evidence to conclude that the DWS does not contain habitat that is unique or otherwise significant to managed fish species and their prey. The trawling equipment used in the 2002 surveys was not an appropriate type for capturing adult rockfish, and the results therefore potentially underestimate adult rockfish use of the site (B. Emmett and B. McCain, NOAA Fisheries' Northwest Fisheries Science Center, personal communication with M. Sommer, Oregon Habitat Branch, NOAA Fisheries, April 15, 2003). However, adults were collected using appropriate trawls during triennial surveys conducted between 1977 and 2001 by NOAA Fisheries' Alaska Fisheries Science Center in the vicinity of the DWS. These surveys demonstrate that proven technologies exist that can gather the information necessary to fully describe baseline fisheries information at the DWS and to compare the site to surrounding areas.

Section 305(b)(4)(B) of the MSA requires the action agencies to provide NOAA Fisheries with a detailed written response to these EFH conservation recommendations, including a description of measures adopted by the action agencies for avoiding, mitigating, or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with NOAA Fisheries' recommendations, the action agencies must explain their reasons for not following the recommendations, including scientific justification for any disagreements with NOAA Fisheries over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effect (50 CFR 600.920(j)).

We would welcome the opportunity to discuss these issues with you and identify how our agencies can work together on finding the best, long-term solution to handling dredged materials from the Columbia River navigation projects. If you have any questions, please contact Ms.

Cathy Tortorici, Columbia River Estuary Coordinator, at 503.231.6268, or Ms. Maggie Sommer, Oregon EFH Coordinator, at 503.230.5422.

Sincerely,

for Michael R Course

D. Robert Lohn
Regional Administrator

Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Mouth of the Columbia River Maintenance Dredging Program
and Ocean Disposal Site Designation

Agency:	U.S. Army Corps of Engineers
Consultation Conducted By:	NOAA's National Marine Fisheries Service, Northwest Region
Date Issued:	July 9, 2003
Issued by:	for Michael R Course D. Robert Lohn Regional Administrator
Refer to:	**2003/00765**

TABLE OF CONTENTS

1. BACKGROUND

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended, established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA's National Marine Fisheries Service (NOAA Fisheries) on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2));

- NOAA Fisheries must provide conservation recommendations for any Federal or state action that would adversely affect EFH (§305(b)(4)(A));

- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries' EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

On February 27, 2003, NOAA Fisheries received a joint EFH assessment from the U.S. Environmental Protection Agency (EPA) and the Portland District of the U.S. Army Corps of Engineers (Corps) (collectively, action agencies) for the Mouth of the Columbia River (MCR) maintenance dredging program and for designation of two ocean dredged material disposal sites. The EFH assessment did not describe existing environmental conditions at one of the ocean disposal sites, the new *deep water site* (DWS), in sufficient detail to allow a thorough evaluation of how EPA's proposed designation would affect EFH, nor did it fully analyze effects of the

designation on EFH. NOAA Fisheries requested additional information needed for the description of existing conditions, the analysis of effects on EFH, and monitoring of the DWS from EPA under the Fish and Wildlife Coordination Act on April 25, 2003, and met with EPA on Monday, May 12, 2003, and with EPA and the Corps on Monday, June 23, 2003, to discuss these issues. Based on these discussions, it is our understanding that EPA does not intend to gather additional baseline information or perform additional effects analyses related to designation of the proposed DWS. Therefore, NOAA Fisheries is concluding this EFH consultation based on the information available to date. Some of the conservation recommendations address these additional information requests.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

2. IDENTIFICATION OF EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for federally managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC 1998a, 1998b).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999). Casillas et al. (1998) provide additional detail on the groundfish EFH habitat complexes. The EFH conservation recommendations are based, in part, on these descriptions and on information provided in the EFH Assessment, in Environmental Protection Agency (2003), and in appendix H of Army Corps of Engineers (1999).

3. PROPOSED ACTIONS AND ACTION AREAS

The proposed action includes dredging the MCR, and the designation of a dredged material disposal site in the ocean under section 102 of the Marine Protection, Research, and Sanctuaries Act (the "Ocean Dumping Act", or ODA). The Portland District of the Corps annually dredges the MCR to maintain adequate depth in the navigation channel. The MCR deep-draft navigation project consists of a ½-mile wide channel extending from 3 miles seaward of the tip of the jetties, to 3 miles upriver. The channel was deepened to its present depths in 1984, and has been maintained at those depths to date. The northerly 2,000 feet of the channel is maintained at a depth of 55 feet (MLW) and the southerly 640 feet is maintained at a depth of 48 feet (MLW). An additional 5 feet of depth is allowed for advanced maintenance. In its present configuration,

the entrance channel has required annual dredging of 4-5 million cubic yards, on average, of fine- to medium-grained sedimentary sand to maintain authorized depths.

Shoaling patterns and needs change continually, so hydrographic surveys (depth) are frequently conducted to track channel conditions throughout the season. The need for dredging is determined by a combination of factors including hydrographic surveys, level of traffic, Coast Guard or other safety concerns, and expressions of concern by local traffic or ports. Typically, the areas of greatest shoaling are dredged first, but considerations such as commercial and seasonal demand are factored into justifications. Dredging is typically limited to the period from May to mid-October because of adverse weather in the winter and spring. Depending upon weather, the Corps has dredged later than October or as early as April or March due to navigational emergencies.

The Corps dredges the channel exclusively with a hopper dredge, because this is the only type of dredge suitable for this environment. Approximately 45% (10-year average) of dredging at the MCR is done with contract hopper dredges and the remainder with the Corps' hopper dredge *Essayons*.

Hopper dredges are seagoing vessels designed to dredge and transport dredged material to open-water disposal areas. Two dragarms, one on each side of the dredge, have dragheads attached to their ends. The dragarms are lowered in the water column until the dragheads are on the channel bottom. On-board pumps create suction in the dragarm, the material is drawn up through the dragheads and arms and deposited in hopper bins in the vessel's midsection. The dragheads are slowly drawn over the bottom by the movement of the ship. When the bins are full, the dredge steams to the designated disposal area and empties the dredged material through large hopper doors in the bottom of the hull, or in split-hull dredges, by opening the full length of the ship. Most dredging operations are done 24 hours a day, 6 days a week depending upon weather and dredge repair needs. The dredge is usually tied up on the seventh day of a given week to change crews and do minor maintenance. Both the contractor and the Corps' dredge can be simultaneously used during this period.

The action agencies, in conjunction with a multi-agency/stakeholder task force, have identified two new ocean disposal sites. One of the sites, identified as the *shallow water site* (SWS), would have the same location as the currently used Expanded Site E and would replace that site. The second site, referred to as the *deep water site* (DWS), would be located in deep water approximately 4.5 miles off the coast of Oregon, slightly south of the MCR, and is considered a new site, having not been used previously.

The SWS is located off the end of the North Jetty and is approximately 2 miles long and from 1,000 to 3,600 feet wide, covering an area of 670 acres. Water depths range from 40 to 70 feet and bottom sediments are primarily medium to fine-grain and very fine-grain sand. The environment of the site is erosive and the bottom is unstable. No benthic samples have been collected in this site, but benthic productivity is likely to be low because of the dynamic nature of the bottom at the site.

The DWS is located about 4.5 miles west of the entrance to the Columbia River and extends westerly an additional 2.5 miles. The site varies in depth from 200-300 feet with a relatively featureless bottom topography that gently slopes away from shore. Overall site dimensions, including a 3000-foot buffer zone, are 17,000 feet by 23,000 feet, occupying an area of approximately 8,976 acres (10.5 square nautical miles). Disposal will only occur in an inner 11,000-foot by 17,000-foot "placement area", which will occupy an area of approximately 4,293 acres (5.0 square nautical miles). The action agencies expect material placed at the site to create a mound approximately 40 feet high within the placement area over the estimated 50-year life of the site. No direct disposal would be allowed anywhere in the buffer; however, dredged materials sloughing off the developing mound may enter the buffer zone.

Benthic populations have been sampled in the DWS and the area is considered to be moderately to highly productive, averaging between 8,000 to 10,000 organisms per meter squared in October and November of 1995 and from 5,000 to 8,000 in June of 1996.

NOAA Fisheries, based upon review of available information, has expanded the list of groundfish species in the action area provided in the EFH Assessment. The action areas includes habitats that have been designated as EFH for various life-history stages of 50 species of groundfish, five coastal pelagic species, and two species of Pacific salmon (Table 1).

4. EFFECTS OF THE PROPOSED ACTION

The proposed site designation and maintenance dredging program would affect EFH for groundfish, coastal pelagic species, and Pacific salmon by altering channel and bottom habitat by dredging and disposal actions.

4.1 Effects of SWS Designation

Designation of the SWS by EPA would not adversely affect EFH relative to existing conditions because the site has been in use since interim designation in 1977, and expansion to its current size in 1997. This long-term disposal of dredged material at the site has severely degraded habitat conditions for managed fish species to the point where the area likely provides few habitat services such as feeding, breeding, spawning, or resting areas.

4.2 Effects of MCR Dredging

Dredging in the MCR would affect EFH in the following ways:

- Altering benthic topography;
- removing or burying benthic invertebrate populations;
- creating temporary, repeated increases in suspended sediment; and
- temporarily reducing migratory habitat by disturbance.

Alteration of benthic topography by dredging and disposal

Continuing maintenance dredging in the navigation channel in the MCR will likely have limited impacts to groundfish, coastal pelagic species, and Pacific salmon. Benthic productivity and structural habitat value are low due to the dynamic nature of the coarse, sandy sediments in the area and past dredging at the site.

Removal or burial of benthic invertebrate populations

Limited removal of organisms via dredging and burying of deposit feeders, suspension/deposit feeders, and suspension feeders will occur in dredged portions of the navigation channel. Because deposit feeders, suspension/deposit feeders, and suspension feeders are prey items for groundfish and coastal pelagic species, any removal of these organisms via dredging or disposal may cause short-term harm to these fish species' EFH. However, the loss of food items is limited, and will not occur in the more important, shallower habitat types. Therefore, the potential for such harm is minimal.

Dredging will result in entrainment of mobile macroinvertebrates. Entrainment by dredges likely is lethal to macroinvertebrates. Groundfish, coastal pelagic species, and Pacific salmon may feed on certain mobile macroinvertebrates, and therefore any loss of these prey items via dredging may harm these species. However, this harm from dredging in the MCR is likely to be localized in areas of low importance to these species. In addition, mobile macroinvertebrates in the estuary appear to be adapted to respond rapidly to disturbances and can recolonize areas following these disturbances, and benthic habitat in the channel is not considered highly productive habitat due to regular disturbance from past and ongoing dredging and ship traffic.

Temporary, repeated increases in turbidity

Proposed dredging may influence suspended sediment concentrations in the Lower Columbia River estuary and river mouth. In areas adjacent to dredges, increases in suspended sediment concentrations may temporarily increase local water column turbidity. Most of the dredging-induced suspended sediment should rapidly settle onto adjacent substrates.

Fish may be attracted to turbidity plumes from dredging activities due to feeding opportunities created by suspension of invertebrates. Juveniles feeding in the area of active dredging may become entrained and killed.

Contaminants associated with dredged sediments may be resuspended in the ecosystem. However, much of the material to be dredged from the navigation channel will originate from existing sand waves, a dynamic natural feature of the river bottom, that are constantly on the move due to current action. These sand waves contain a small percentage of fine sediments and organic material, and thus only minimal amounts of contaminants are likely to become resuspended from current action or dredging and disposal.

Temporary, repeated disturbance of migratory habitat
Disturbance of migrating fish is likely to be minor because the area in which the dredge is operating at one time is small compared to the total width of the river mouth, and because the dredges operate intermittently.

4.3 Effects of Disposal at the SWS

Potential impacts from disposal at the SWS include alteration of bottom topography, elimination of benthic invertebrate populations, temporary increase in suspended sediment, and temporary disturbance of fish while working in the area. Productivity and habitat value of this site are likely low due to prior disturbance and the erosive, dynamic nature of the seabed in this area. Dredged material disposal at the SWS is likely to have minor adverse effects to EFH for groundfish, coastal pelagic species, and Pacific salmon, since this location has already been used as a dredged material disposal site.

4.4 Effects of Disposal at the DWS

Potential adverse effects of dredged material disposal at the DWS on groundfish, coastal pelagic species, and Pacific salmon EFH include:

- Alteration of bottom topography;
- elimination of benthic invertebrate populations that provide food or structural habitat for managed fish species;
- alteration of sediment structure/composition;
- disruption of physical processes in the water column;
- dispersal of sediments outside of the designated site;
- temporary increases in turbidity during and immediately following disposal; and
- temporary reduction of EFH from disturbance during disposal events.

Alteration of bottom topography
The proposed designation and subsequent use will result in the eventual creation of a 40-foot high, trapezoidal mound of sediment at the DWS. Although all material is to be placed within the inner drop zone during any use of the DWS, midwater or bottom currents and slumping likely will cause sediment dispersal during or after settling, and will result in the transport of some material into and possibly beyond the buffer zone. This will increase the size of the actual disposal footprint to larger than the proposed area. It is unclear from the discussion in appendix I, exhibit N of the final supplemental EIS if the analysis applies to sediment movement in general, or specifically to the resulting 40-foot high mound of sediment. Further investigation will be required to evaluate how mounding affects fish use and invertebrate community composition at the site.

Mounding at the disposal site is likely to affect wave action and currents and, in turn, may affect the Columbia River plume (*e.g.* by changing its location and characteristics). EFH for groundfish, Pacific salmon, and coastal pelagic species may be affected by changes in

hydrodynamic characteristics at the site and to the Columbia River plume. In order to address this concern, more information about potential effects is necessary.

Elimination of benthic invertebrate populations

Information collected by the Corps at the DWS confirms that the area has a variety of bottom types supporting a diverse community of benthic invertebrates. The substrate at the DWS has been characterized as having five different bottom types (fine sand/silt, polychaete tubes; fine sand/silt, indistinct polychaete tubes; fine sand; sand/sand waves; and sand), and 29 species of benthic invertebrates (October 29, 2002, Ocean Disposal Taskforce meeting; presentation: *MCR Ocean Disposal Sites, Preliminary Results on 200 Surveys*, MEC Analytical Systems, SAIC and EHI, 28-29, October; attachment D, exhibit N final supplemental EIS). Sampling in July and September of 2002 showed seasonal changes in benthic invertebrate assemblages, suggesting that the area is affected by seasonal variations in level of detrital input and water movement/flow from the Columbia River. These results indicate that the DWS likely is highly productive, providing a diversity of prey for groundfish species.

Benthic invertebrates such as polychaete worms, crustaceans, molluscs, crinoids, etc. provide food and structural habitat for many managed fish species in the area of the DWS (Love *et al.* 2002). Many of these benthic organisms have limited mobility and would be buried and killed by the disposal of dredged sediments at the site. The result would be a reduction in the potential food source and habitat available to fish species in the area. Recolonization is uncertain while the site is in active use for dredged material disposal (projected 50-year life span), since the maximum interval between disposal events would be approximately one year. Recolonization potential is affected by the length of intervals between deposition events, particle size, currents, and compaction/stabilization following deposition (Newell *et al.* 1998; Van der Veer *et al.* 1985). Rates of recovery listed in the literature range from several months for estuarine muds, and up to 2-3 years for sands and gravels (Hitchcock *et al.*1999). Recolonization may take longer in areas with lower nutrient levels and low currents, such as the DWS (Van der Veer *et al.* 1985).

Alteration of sediment structure/composition

Sediments to be disposed of at the site would be coarser than those currently there. Regular disturbance and changes in sediment type are likely to result in different benthic organisms inhabiting the area (R. Wheatcroft, Oregon State University, personal communication with M. Sommer, Oregon Habitat Branch, NOAA Fisheries, April 17, 2003). If new communities of benthic invertebrates are able to become established at the site, they may not include specific prey species required by managed fish species foraging in the area.

Disruption of physical processes in the water column

The presence of a mound of disposed sediments may alter bottom currents, with possible unanticipated effects on the benthic and water column microhabitats in the immediate area of the DWS, as well as on bottom flows and onshore nutrient transport. Processes such as the movement of dense near-bottom fluid (*i.e.*, water combined with suspended and dissolved materials) onshore during upwelling and offshore during downwelling; propagation of internal

waves within the bottom fluid layer moving back up the continental shelf during downwelling; and the movement of bottom-trapped and highly nonlinear, large-amplitude solitary waves enrich the water column over the shelf from deeper, offshore waters. Disruption of these flows would affect the onshore transport of nutrients (J. Moum, Oregon State University, personal communication with M. Sommer, Oregon Habitat Branch, NOAA Fisheries, April 17, 2003), potentially degrading habitat around and inshore of the DWS.

The sediment mound may also alter the Columbia River plume. Mounding at the DWS (which is in the vicinity of the Columbia River plume) could affect wave action and current characteristics, and, in turn, affect the plume by changing its location or other characteristics. Effects to fish from disruption of the Columbia River plume could include interference with or displacement of feeding or migratory activity, reduced prey availability, and altered predator abundance.

Dispersal of sediments outside of the designated DWS

Sediments disposed of at the DWS can reasonably be expected to be re-mobilized by bottom currents and waves (R. Wheatcroft, C. Goldfinger, and J. Moum, Oregon State University, personal communication with M. Sommer, Oregon Habitat Branch, NOAA Fisheries, April 17, 2003), although the Corps believes the sediments will not move once on the bottom at the site (appendix I, exhibit N, final supplemental EIS). Therefore, the potential area affected could extend beyond the DWS. In particular, sediments may tend to move northward, driven by winter currents, toward Astoria Canyon. Appendix A, exhibit N of the final supplemental EIS identifies sediment pathways, but does not discuss them in the context of potential impacts to the Astoria Canyon. NOAA Fisheries is concerned about potential sediment movement because the habitat types found in and bordering on Astoria Canyon are geographically limited and may provide unique or otherwise especially valuable habitat to managed fish species (W. Wakefield, NOAA Fisheries Northwest Fisheries Science Center, personal communication, April 11, 2003).

Any problems caused by the movement of a limited amount of dredged material into the canyon more likely would stem from contaminants associated with the material than with the sediments themselves (C. Goldfinger, Oregon State University, personal communication to M. Sommer, Oregon Habitat Branch, NOAA Fisheries, April 17, 2003; W. Wakefield, NOAA Fisheries Northwest Fisheries Science Center, personal communication, Oregon Habitat Branch, NOAA Fisheries, April 18, 2003). Appendix B (pages 8-9), exhibit N of the final supplemental EIS identifies a chemical baseline for the DWS. Sediments to be disposed at the site will be tested and must meet the ocean disposal standards in the dredged material evaluation framework (DMEF). Existing contaminant loadings at the site may be exacerbated by the addition of dredged materials. The DMEF is currently under review to address contaminant testing requirements and sediment disposal criteria for groundfish and ESA-listed species. Until that review is completed, potential effects on fish and suitability of dredged material from this project for disposal at the DWS remain somewhat uncertain.

Temporary increases in turbidity during and immediately following disposal events
The EPA expects sediments to reach the ocean floor at the DWS approximately 35 minutes after being dumped. Suspended sediments could remain elevated in the area for longer periods of time than the actual release of dredged material from the transporting ships, and the exposure to suspended sediment plumes from dredged material disposal will probably be on the order of minutes to hours in duration (Wilbur and Clarke 2001). Turbidity, including that due to suspended sediment, can at moderate levels reduce primary and secondary productivity, and at high levels can injure or kill adult and juvenile fish, and may also interfere with feeding (Bjornn and Reiser 1991; Servizi and Martins, 1991; Spence *et al.* 1996). In salmonids, behavioral avoidance of turbid waters may be one of the most important effects of elevated suspended sediments (Scannell 1988, Birtwell *et al*. 1984, DeVore *et al*. 1980). Little is known about the behavior of most groundfish and coastal pelagic species in response to suspended sediments. Factors affecting response to elevated suspended sediments include fish size, water temperature, shape of the suspended particles, and particle concentration (Servizi and Martins 1991).

Temporary reduction of EFH from disturbance during disposal of dredged material
Disposal of dredged material is likely to occur regularly during the dredging season. Disturbance from dredged material settling through the water column to the bottom may cause fish to move out of or avoid the area during disposal events. This result would result in temporary but recurrent reductions in the amount of EFH available for fish use.

4.5 Impacts to Groundfish Species of Particular Concern

The area of EFH affected by the DWS is minimal relative to the total ranges of the managed species. NOAA Fisheries has not determined a percentage of habitat area that would be adversely affected by use of the DWS. Since 1996, the Pacific Fishery Management Council has declared nine species of groundfish under its management to be overfished (*i.e.*, with current biomass below 25% of the estimated unexploited level). The February, 2003 EFH assessment for the MCR maintenance dredging program does not address in sufficient detail the potential effects of the proposed action on the habitat any of these species.

The overfished status of these stocks calls for special consideration of the biological implications of effects on EFH. Several of the overfished species are not of particular concern in this instance, either because they are found entirely or primarily south of the action area (*i.e.*, cowcod, bocaccio), or are not strongly associated with benthic habitats at any life stage (*i.e.*, Pacific whiting). Stock status, life histories, and potential adverse impacts to EFH from the proposed activities are discussed in greater detail below for each of the remaining six overfished species: (1) Darkblotched rockfish, (2) lingcod, (3) canary rockfish, (4) widow rockfish, (5) Pacific ocean perch, and (6) yelloweye rockfish.

Darkblotched Rockfish
Darkblotched rockfish were at 14% of unfished levels in 2002, with estimated recovery time with no fishing at 14 years (PFMC 2003). Ninety-five percent of darkblotched rockfish are found at depths of 50-400 meters (Allen and Smith 1988), and both juveniles and adults prefer

soft substrates and low-relief reefs (Love *et al.*, 2002). Thirty-two darkblotched rockfish, primarily juveniles, were caught in 9 out of 42 bottom trawls in the area of the proposed DWS during triennial surveys conducted between 1977 and 2001 by NOAA Fisheries' Alaska Fisheries Science Center (M. Wilkins, NOAA Fisheries Northwest Fisheries Science Center, personal communication to C. Tortorici, Oregon Habitat Branch, NOAA Fisheries, October 16, 2002). Because of this species' preference for habitat types like the DWS and its demonstrated occurrence in the area, the disposal of dredged material at the site is likely to adversely affect EFH for darkblotched rockfish.

Lingcod

The population of lingcod has decreased 85% in the last 30 years; stock in the International North Pacific Fisheries Commission's Columbia subarea is estimated at 8.8% of unfished levels (Jagielo *et al.* 1997). High catch rates are reported off the Columbia River (Love *et al.* 2002). Lingcod are found at depths of 0-475 meters (Casillas *et al.* 1998). Adults are common in areas shallower than 200 meters, and juveniles are common shallower than 150 meters (Jagielo *et al.* 1997). They are demersal, usually preferring rock reefs, algae beds, and areas with high current. One hundred and twenty-eight lingcod were caught in 24 out of 42 bottom trawls in the area of the proposed DWS during triennial surveys conducted between 1977 and 2001 by NOAA Fisheries' Alaska Fisheries Science Center (M. Wilkins, NOAA Fisheries Northwest Fisheries Science Center, personal communication to Cathy Tortorici, Oregon Habitat Branch, NOAA Fisheries, October 16, 2002). Because of this species' demonstrated occurrence in the area, disposal of dredged material at the site is likely to adversely affect EFH for lingcod.

Canary Rockfish

Spawning biomass of canary rockfish was estimated in 2002 to be 8% of the unfished level, and there have been severe declines since 1999 (Methot and Piner 2002b). The estimated stock recovery time with no fishing is 57 years (Methot and Piner 2002a). Oregon has a major population of canary rockfish off Oregon (Casillas *et al.* 1998). Most canary rockfish are found at depths of 80-200 meters (Love *et al.* 2002); however, juveniles may settle from their planktonic stage to the bottom at shallower depths and migrate deeper down the continental shelf as they age (Love 1991). Adult canary rockfish prefer hard bottoms, rock reefs, and pinnacles (Love *et al.* 2002). Forty canary rockfish (juveniles and adults) were caught in 7 out of 42 bottom trawls in the area of the proposed DWS during triennial surveys conducted between 1977 and 2001 by NOAA Fisheries' Alaska Fisheries Science Center (M. Wilkins, NOAA Fisheries Northwest Fisheries Science Center, personal communication to Cathy Tortorici, Oregon Habitat Branch, NOAA Fisheries, October 16, 2002). Because of this species' demonstrated occurrence in the area, disposal of dredged material at the site is likely to adversely affect EFH for canary rockfish.

Widow Rockfish

Widow rockfish were at 23.6% of the unfished level in the most recent assessment (Williams *et al.* 2000). They are a deep water species; most adults are found at depths of 100-300 meters, although large juveniles may be found as shallow as 9 meters (NOAA 1990; Eschmeyer *et al.* 1983). Widow rockfish prefer rocky banks and ridges, seamounts, and mud near rocks (Love *et*

al. 2002). One individual of this species was found in one out of 42 bottom trawls in the area of the proposed DWS during triennial surveys conducted between 1977 and 2001 by NOAA Fisheries' Alaska Fisheries Science Center (M. Wilkins, NOAA Fisheries Northwest Fisheries Science Center, personal communication to Cathy Tortorici, Oregon Habitat Branch, NOAA Fisheries, October 16, 2002). Disposal of dredged material at the site may adversely affect EFH for widow rockfish, but because of this species' preference for high-relief habitats and low demonstrated occurrence in the area, such effects are likely to be minimal. However, because of the species' overfished status, the action agencies should specifically consider widow rockfish in the monitoring and management of the DWS.

Pacific Ocean Perch

Pacific ocean perch were at 21.7% of the unfished level in 1998 (Ianelli *et al.* 2000). They are a deep water species, with most found at depths of 100-450 meters (NOAA 1990). Juveniles may be found as shallow as 37 meters, and move deeper with age (Love *et al.* 2002) Pacific ocean perch are primarily planktivores; they are an important forage fish for salmon, lingcod, sablefish, other groundfish, seals, and tuna (Love *et al.* 2002). Pacific ocean perch prefer rocky structures and sea whips, as well as canyons and submarine depressions (NOAA 1990). No Pacific ocean perch were observed in any of the 42 bottom trawls conducted in the area of the proposed DWS during triennial surveys between 1977 and 2001 by NOAA Fisheries' Alaska Fisheries Science Center (M. Wilkins, NOAA Fisheries Northwest Fisheries Science Center, personal communication to Cathy Tortorici, Oregon Habitat Branch, NOAA Fisheries, October 16, 2002). Disposal of dredged material at the site may adversely affect EFH for Pacific ocean perch, but because of this species' preference for high-relief habitats, low demonstrated occurrence in the area, and preference for planktonic prey, the effects are likely to be minimal. However, because of the species' overfished status, the action agencies should specifically consider Pacific ocean perch in the monitoring and management of the DWS.

Yelloweye Rockfish

Yelloweye rockfish stocks have declined continuously over the last 30 years and are at 13% of the unfished level in Oregon (Wallace 2001). Stock rebuilding time with zero fishing is estimated to be at least several decades (Wallace 2001). Yelloweye rockfish are found in rugged, rocky habitats at depths of 25-550 meters (Allen and Smith 1988). No instances of this species were observed in any of the 42 bottom trawls conducted in the area of the proposed DWS during triennial surveys between 1977 and 2001 by NOAA Fisheries' Alaska Fisheries Science Center (M. Wilkins, NOAA Fisheries Northwest Fisheries Science Center, personal communication to Cathy Tortorici, Oregon Habitat Branch, NOAA Fisheries, October 16, 2002). Disposal of dredged material at the site may adversely affect EFH for yelloweye rockfish, but because of this species' preference for high-relief habitats and low demonstrated occurrence in the area, effects are likely to be minimal. However, because of its overfished status, the action agencies should specifically consider yelloweye rockfish in the monitoring and management of the DWS.

5. CONCLUSION

EFH for groundfish, coastal pelagic species, and Pacific salmon will not be adversely affected by designation of the SWS, since it has been in use for dredged material disposal since 1977. Habitat quality at the site has been severely degraded due to this historic and continuing use, and it is not likely to receive significant use by any managed fish species.

NOAA Fisheries believes that the MCR dredging component of the proposed action will have adverse effects to EFH for groundfish, coastal pelagic species, and Pacific salmon in the Lower Columbia River and estuary. Expected impacts to key physical and biological processes (*i.e.*, alteration of benthic topography, increase in suspended sediment) will be limited and short-term in duration during maintenance dredging.

EFH for groundfish would be adversely affected by use of the DWS for disposal of dredged material as part of the MCR maintenance dredging program and other potential dredging projects that may use the site. Adverse effects to groundfish EFH would be significant in the immediate location of the site. The DWS, which encompasses 10.5 square nautical miles, is small relative to the total habitat area available to the species involved, most of which occupy ranges that extend along large portions of the west coast of North America. The overall impacts to the affected groundfish species from adverse effects to EFH at the SWS and DWS are not likely to be evident on a population scale. The likelihood of significant adverse effects to EFH for coastal pelagic species or Pacific salmon from use of the DWS is uncertain, and requires more investigation into the potential effects to the Columbia River plume from the resulting mound of accumulated sediments at the site. In reaching these conclusions, NOAA Fisheries relied on the best available scientific and commercial data.

5.1 EFH Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NOAA Fisheries is providing the following EFH conservation recommendations for the MCR maintenance dredging program:

<u>Deep Water Site</u>

1. The action agencies should conduct more detailed analyses of the DWS to determine the importance of the area relative to the surrounding ocean floor in terms of habitat quality for managed fish and their major prey species. This analysis should involve a re-evaluation of the information in Appendix H of FEIS - Exhibit A and the report, Environmental Studies at Proposed Ocean Disposal Site off the Mouth of the Columbia River, Final Report, 2003, to conduct a habitat-based analysis of alternatives to the proposed action that could avoid or minimize adverse effects on EFH, as required by the Federal EFH regulations (50 CFR 600.920(e)(4)(iv)). Studies should include a survey for fish presence at the site using sampling gear and methods appropriate for capturing adult and juvenile groundfish. This should be completed before the site is used for disposal so that adequate pre-disposal baseline information is available for comparison with information from future monitoring.

2. The action agencies should revise the Site Management/Monitoring Plan (SMMP), (Mouth of the Columbia River (MCR), Shallow Water and Deep Water, Ocean Dredge Material Disposal Sites (ODMDS)) in cooperation with NOAA Fisheries, in order to assess biological impacts of disposal at the DWS. A comprehensively developed SMMP is necessary for verification of assumptions and conclusions regarding long-term effects to EFH for groundfish, coastal pelagic species, and Pacific salmon. When implemented, monitoring should focus on effects to benthos (*e.g.*, invertebrate recolonization) and dependent fish species. The action agencies need to fully discuss the following elements in the SMMP:

   - How the buffer zone is going to be used as a reference site;
   - Where in the monitoring process (Figure 4., page 19) of the SMMP the reference site is included as part of the actual monitoring process;
   - What are the specific triggers (page 16 of the SMMP) and quantified changes (page 17 of the SMMP) that the actions agencies will used to determine whether a change in the monitoring program and/or site management is necessary;
   - How the action agencies define the word "significantly" in the portion of the SMMP describing Typical Evaluation Questions;
   - The structure and decision-making process to be used to implement the portion of the SMMP devoted to Coordinated Management of the Site (page 20). Re-valuation of this portion of the SMMP should include the development of an adaptive management plan for the DWS ; and
   - How monitoring of mounding at the the DWS will be used to determine impacts to the Columbia River plume environment for Pacific salmon.

3. The action agencies should expand the monitoring area to assess whether sediments are re-mobilized and transported out of the designated site, and effects to habitat in areas receiving the sediments. This analysis should re-evaluation whether it appropriate to use the buffer zone as the reference site for the DWS.

6. RESPONSE REQUIREMENT

Section 305(b)(4)(B) of the MSA requires the action agencies to provide NOAA Fisheries with a detailed written response to these EFH conservation recommendations, including a description of measures adopted by the action agencies for avoiding, mitigating, or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with NOAA Fisheries' recommendations, the action agencies must explain their reasons for not following the recommendations, including scientific justification for any disagreements with NOAA Fisheries over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effect (50 CFR 600.920(j)).

7. REFERENCES

Allen, M.J. and G.B. Smith. 1988. Atlas and zoogeography of common fishes in the Bering Sea and northeastern Pacific. NOAA, NMFS Tech. Rep. 66: 151 pp.

Bjornn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. In Influences of forest and rangeland management on salmonid fishes and their habitats. W.R. Meehan (ed). American Fisheries Society Special Publication 19:83-138.

Casillas, E., L. Crockett, Y. deReynier, J. Glock, M. Helvey, B. Meyer, C. Schmitt, M. Yoklavich, A. Bailey, B. Chao, B. Johnson, and T. Pepperell, 1998. Essential Fish Habitat West Coast Groundfish Appendix. Seattle, Washington, National Marine Fisheries Service: 778 p.

Environmental Protection Agency. 2003. Ocean dumping: proposed de-designation of sites and proposed designation of new sites at the Mouth of the Columbia River, Oregon and Washington. Federal Register 68(47): 11488.

Eschmeyer, W.N., E.S. Herald, and H. Hammon. 1983. A field guide to Pacific Coast fishes of North America. Houghton Mifflin, Boston, Massachusetts. 336 p.

Hitchcock, D.R., R.C. Newell and L.J.Seiderer. 1999. Investigation of benthic and surface plumes associated with marine aggregate mining in the United Kingdom-final report. Contract report for the U.S. Department of the Interior, Minerals Management Service.

Ianelli, J.N., M. Wilkins, and S. Harley. 2000. Status and future prospects for the Pacific ocean perch resource in waters off Washington and Oregon as assessed in 2000. Appendix to Status of the Pacific Coast groundfish fishery through 1997 and recommended acceptable biological catches for 1998. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland, Oregon.

Jagielo, T., P. Adams, M. Peoples, S. Rosenfield, K.R. Silberberg, and T.E. Laidig. 1997. Assessment of lingcod in 1997. Appendix to status of the Pacific Coast groundfish fishery through 1997 and recommended acceptable biological catches for 1998. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland, Oregon.

Love, M.S. 1991. Probably More than You Want to Know about the Fishes of the Pacific Coast. Really Big Press, Santa Barbara, California. 215 pp.

Love, M.S., M. Yoklavich, and L. Thorsteinson, 2002. The Rockfishes of the Northeast Pacific. University of California Press, Berkeley and Los Angeles, California. 404 pp.

Methot, R., and K. Piner. 2002a. Rebuilding analysis for canary rockfish update to incorporate results of coastwide assessment in 2002. In Volume 1 Status of the Pacific Coast groundfish fishery through 2002 and recommended acceptable biological catches for 2003. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland, Oregon.

Methot, R., and K. Piner. 2002b. Status of the canary rockfish resource off California, Oregon and Washington in 2001. Volume 1. Status of the Pacific Coast groundfish fishery through 2002 and recommended acceptable biological catches for 2003. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland, Oregon.

Newell, R.C., L.J. Seiderer and D.R. Hitchcock. 1998. The impact of dredging on biological resources of the sea bed. Oceanography and Marine Biology Annual Review 36: 127-178.

NOAA (National Oceanic and Atmospheric Administration). 1990. West coast of North America coastal and ocean zones strategic assessment: Data atlas. U.S. Department of Commerce. NOAA. OMA/NOS, Ocean Assessments Division, Strategic Assessment Branch. Invertebrate and Fish Volume.

PFMC (Pacific Fishery Management Council). 1998a. Final environmental assessment/ regulatory review for Amendment 11 to the Pacific Coast groundfish fishery management plan. Portland, Oregon, Pacific Fishery Management Council.

PFMC (Pacific Fishery Management Council). 1998b. The coastal pelagic species fishery management plan: Amendment 8. Portland, OR, Pacific Fishery Management Council.

Pacific Fishery Management Council. 1999. Appendix A. Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon. Amendment 14 to the Pacific Coast salmon plan. Portland, Oregon.

Pacific Fishery Management Council. 2003. Final Environmental Impacts Statement for the Proposed Groundfish Acceptable Biological Catch and Optimum Yield Specifications and Management Measures: 2003 Pacific Coast Groundfish Fishery. Pacific Fishery Management Council, Portland, Oregon.

Servizi, J.A. and D.W. Martens. 1991. Effect of temperature, season, and fish size on acute lethality of suspended sediments to coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences 48: 493-497.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6057. ManTech Environmental Research

Services Corp., Corvallis, Oregon. (Available from the National Marine Fisheries Service, Portland, Oregon). 356 p.

U.S. Army Corps of Engineers. 1999. Appendix H, Volume 1: Ocean Dredged material disposal sites main report and technical exhibits, integrated feasibility report for channel improvements and environmental impact statement. Columbia and Lower Willamette River federal navigation channel.

U.S. Army Corps of Engineers. 2003. Columbia River Chanel Improvement Project, final supplemental integrated feasibility report and environmental impact statement, Volume 3, Exhibit N.

Van der Veer, H.W., M.J.N. Bergmen and J.J. Geukema. 1985. Dredging activities in the Dutch Wadden Sea: effects on macrobenthic infauna. Netherlands Journal for Sea Research 19:183-190.

Wallace, F.R. 2001. Status of the Yelloweye Rockfish Resource in 2001 for Northern California and Oregon Waters. Appendix to the Status of the Pacific Coast Groundfish Fishery Through 2001 and Acceptable Biological Catches for 2002. Stock Assessment and Fishery Evaluation. (In press). Pacific Fishery Management Council, Portland, Oregon.

Wilber, D.H. and D.G. Clarke. 2001. Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. North American Journal of Fisheries Management 21: 855-875.

Williams, E.H., A.D. MacCall, S. Ralston, and D.E. Pearson. 2000. Status of the widow rockfish resource in Y2K. Appendix to Status of the Pacific coast groundfish fishery through 2000 and recommended acceptable biological catches for 2001. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland, Oregon.

Table 1. Fish Species with EFH in the Mouth of the Columbia River Maintenance Dredging Program Action Areas (including the Deep Water Site)

Species	Adults	Spawning/ Mating	Eggs/ Parturition	Larvae	Juveniles/ Small Juveniles	Large Juveniles	Habitat Preferences	Depth Range
GROUNDFISH								
Darkblotched Rockfish *Sebastes crameri*	X	X	X			X	soft bottoms, rocks, bottom structures; prefer soft substrate, low relief reefs.	95% 50-400m. Benthic juveniles in Oregon may be found between 55-200m
Canary Rockfish *Sebastes pinniger*					X		hard bottoms, rock reefs, pinnacles, drop-offs	most 91-183m (settle shallow & move deeper with age)
Pacific Ocean Perch *Sebastes alutus*	X					X	rocky structures; sea whips	97% 100-450m
Widow Rockfish *Sebastes entomelas*	X	X	X		X	X	rocky banks, ridges, seamounts, mud near rocks	mostly 100-300m; large juveniles 9-37m
Lingcod *Ophiodon elongatus*	X	X	X			X	rock reefs, algae, high current	0-475m; adults common 10-70m, juveniles<150m
Yellowmouth Rockfish *Sebastes reedi*						NA	rocky, rough bottom	adults: 137-366m
Arrowtooth Flounder *Atheresthes stomias*	X	X			X	NA	sand, mud, sandy gravel	18-900m
Butter Sole *Isopletta isolepsis*	X	X				NA	mud, silt	0-366m
Curlfin Sole *Pleuronectes decurrens*	X	X				NA	soft bottoms	most 0-90m
Dover Sole *Microstomus pacificus*	X	X			X	NA	mud, muddy sand	adults: 91-1010m, most below 200m; juveniles: 100-700m, most below 200m; post-settlement nursery area between 100-119m off OR

Table 1. Continued.

Species	Adults	Spawning/ Mating	Eggs/ Parturition	Larvae	Juveniles/ Small Juveniles	Large Juveniles	Habitat Preferences	Depth Range
English Sole *Pleuronectes vetulus*	X	X			X	NA	sand, mud	most 0-250m
Flathead Sole *Hippoglossoides elassodon*	X	X			X	NA	mud, sand	most 0-366m
Pacific Sanddab *Citharichthys sordidus*	X	X			X	NA	sand	most between 37-90m in OR & WA
Petrale Sole *Eopsetta jordani*	X				X	NA	mud, sand	most 0-300m
Rex Sole *Glyptocephalus zachinus*	X	X			X	NA	mud, sand	96% 50-450m
Rock Sole *Lepidopsetta bilineata*	X	X	X		X	NA	sand, gravelly bottoms, mud-sand	most 0-300m
Sand Sole *Psettichthys melanosticus*	X	X			X	NA	mud, sand	most <150m, prefer shallower
Starry Flounder *Platichthys stellatus*	X	X			X	NA	mud, sand; often found in estuaries and upstream in freshwater	most <150m
Big Skate *Raja binoculata*	X	X	X	NA	X	NA	mud	most common 50-200m; egg cases by far most abundant at 64m
California Skate *Raja inornata*	X	X	X	NA	X	NA	mud	common shallow, inshore; found to 671m
Longnose Skate *Raja rhina*	X	X	X	NA	X	NA	mud	most frequent 100-150m
Soupfin Shark *Galeorhinus zyopterus*	X	X	X	NA	X	NA	mud	2-471m
Spiny Dogfish *Squalus acanthias*	X		X	NA		X	mud	most < 300m
Pacific Cod *Gadus macrocephalus*	X	X	X		X	NA	mud, sand, clay, gravel	most common 50-300m

Table 1. Continued.

Species	Adults	Spawning/ Mating	Eggs/ Parturition	Larvae	Juveniles/ Small Juveniles	Large Juveniles	Habitat Preferences	Depth Range
Pacific Rattail *Coryphaenoides acrolepis*	X	X			X	NA	sand	most common below 1500m in NE Pac
Sablefish *Anoplopoma fimbria*	X					X	mud, sand	adults prefer deep (>200m) water but juveniles are found inshore and inhabit progressively deeper waters with age
Spotted Ratfish *Hydrolagus colliei*	X	X	X	NA	X	NA	mud, low relief rocky bottom, gravel, cobble	most common 100-150m
Aurora Rockfish *Sebastes aurora*	X	X				X	soft bottom	96% 150-500m
Black Rockfish *Sebastes melanops*						X	kelp, seagrass beds, high relief rock	most 12-54m
Blue Rockfish *Sebastes mystinus*						X	kelp, high relief rock	most 25-40m
Bocaccio *Sebastes paucispinis*	X				X	X	midwater, over rock, algae, sometimes firm sand/mud; migrate offshore with age	Most common between 100-150m
Brown Rockfish *Sebastes auriculatus*						NA	low relief hard bottoms, drift algae, canyons	most common <53m
Chilipepper *Sebastes goodei*	X		X		X	X	high relief rock; occasionally on flat, hard bottoms	most 75-325m
China Rockfish *Sebastes nebulosus*						NA	rock reefs, cobble, high-energy areas	most <92m
Copper Rockfish *Sebastes caurinus*					X	NA	generalists but never on exclusively sand	0-183m

Table 1. Continued.

Species	Adults	Spawning/ Mating	Eggs/ Parturition	Larvae	Juveniles/ Small Juveniles	Large Juveniles	Habitat Preferences	Depth Range
Greenspotted Rockfish *Sebastes chlorosticus*	X		X		X	NA	high-relief rock reefs, soft bottoms: juveniles: soft bottoms	adults: 90-179m; juveniles: 30-89m
Greenstriped Rockfish *Sebastes elongatus*	X		X		X	NA	mud, sand, rock	95% 150-250m; juveniles 30-89m
Quillback Rockfish *Sebastes maliger*					X		rocks, coarse sand or pebbles next to reefs	most 21-60m
Redbanded Rockfish *Sebastes babcocki*	X					NA	soft and hard substrate	97% 150-450m
Rosethorn Rockfish *Sebastes helvomaculatus*	X		X			NA	boulders, cobbles, sponges, rock	96% 100-350m
Rougheye Rockfish *Sebastes aleutianus*	X				X	NA	soft bottoms	94% 50-450m
Sharpchin Rockfish *Sebastes zacentrus*	X		X			NA	rock, mud, dense crinoid fields	96% 100-350m
Shortbelly Rockfish *Sebastes jordani*	X		X		X		juveniles: soft bottoms	most 150-200m
Shortraker Rockfish *Sebastes borealis*	X					NA	fine-grained sediment; boulders, pebbles, hard steep slopes	95% 50-650m; most common below 200m
Shortspine Thornyhead *Sebastolobus alascanus*	X				X	NA	mud	100-1400m
Silverygray Rockfish *Sebastes brevispinis*	X					NA	rocky bottoms	95% 100-300m
Splitnose Rockfish *Sebastes diploproa*	X		X		X	NA	mud near rocks, soft low-relief substrate	98% 100-450m

Table 1. Continued.

Species	Adults	Spawning/ Mating	Eggs/ Parturition	Larvae	Juveniles/ Small Juveniles	Large Juveniles	Habitat Preferences	Depth Range
Stripetail Rockfish *Sebastes saxicola*	X		X		X	NA	sand, soft bottoms	97% 10-350m
Vermilion Rockfish *Sebastes miniatus*					X	NA	adults: rocks & hard substrate; juveniles: sand with no algae, hard or soft low-relief substrate	adults: 7-239m, juveniles 5-30m
Yellowtail Rockfish *Sebastes flavidus*	X	X	X		X	X	rocky structures, steep slopes	most 140-210m, juveniles: 20-37m
COASTAL PELAGIC SPECIES								
Northern Anchovy *Engraulis mordax*	X		X	X	X	X	pelagic	n/a
Pacific Sardine *Sardinops sagax*	X		X	X	X	NA	pelagic	n/a
Pacific (Chub) Mackerel *Scomber japonicus*	X		X	X	X		pelagic	n/a
Jack Mackerel *Trachurus symmetricus*	X						pelagic	n/a
California Market Squid *Loligo opalescens*	X	X	X	X	X		pelagic; eggs attached to sand/mud bottoms	shelf

Table Legend:

X = The EFH for the particular species and life stage occurs in the Columbia River Channel Improvement Project action area (including the Deep Water site).

Blank = The EFH for the particular species and life stage is not currently known to occur within the action area, or insufficient information is currently available to establish occurrence within the action area.

NA = Not applicable. It is used in two ways: when a species does not have a particular life stage in its life history (gray background), ***or*** when EFH of juveniles is not identified separately for small juvenile and large juvenile stages. For many species, habitats occupied by juveniles differ substantially, depending on the size (or age) of the fish.

Table 1. Continued.

Frequently, small juveniles are pelagic and large juveniles live on or near the bottom; these life stages are identified separately in the following tables when sufficient information is available to do so. When juvenile habitats do not differ so substantially ***or*** when information is insufficient to identify differences, EFH is identified only for the juvenile stage (small and large juveniles combined), and NA (not applicable) is listed in the column for the large juvenile stage in the tables.

Information in this table compiled from:

Casillas, E., L. Crockett, Y. deReynier, J. Glock, M. Helvey, B. Meyer, C. Schmitt, M. Yoklavich, A. Bailey, B. Chao, B. Johnson, and T. Pepperell, 1998. Essential Fish Habitat West Coast Groundfish Appendix. Seattle, Washington, National Marine Fisheries Service: 778 pp.

Emmett, R. L., S. L. Stone, et al. (1991). Distribution and abundance of fishes and invertebrates in west coast estuaries, Volume II: Species life history summaries. Rockville, MD, NOAA/NOS Strategic Environmental Assessments Division**:** 329.

Love, M.S. 1991. Probably more than you want to know about the fishes of the Pacific Coast. Really Big Press, Santa Barbara, California. 215 pp.

Pacific Fishery Management Council. 2003. Final Environmental Impact Statement for the Proposed Groundfish Acceptable Biological Catch and Optimum Yield Specifications and Management Measures: 2003 Pacific Coast Groundfish Fishery. Pacific Fishery Management Council, Portland, Oregon.